

# Articles

## Health Care Cost Effects of Public Use of a Regional Poison Control Center

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Poison control centers in the United States are threatened with closure, and attempts at a cost-benefit analysis of these services have been indeterminate. The purpose of this study was to compare the operating costs of a regional poison control center resulting from public use of its telephone hotline services with those of hypothetical alternative sources of advice and care. We conducted a follow-up telephone survey among 589 public callers to the San Francisco Bay Area Regional Poison Control Center who had been managed at home without medical referral after an unintentional poisoning. All survey respondents were asked what alternative action they would have taken had the poison control center not been available to assist them by telephone consultation. We then surveyed emergency departments and physicians' offices cited as alternatives by the callers to determine their response and charges for evaluating a suspected poisoning case. A total of 464 (79%) of the callers surveyed would have sought assistance from their local emergency health care system had the poison control center not been available. We conservatively estimated that the total charges for such evaluations would be \$71,900. Comparatively, the total actual operating cost of services provided by the poison control center for all 589 poisoning cases was \$13,547. Most of the study subjects (429 [73%]) had private insurance coverage. Direct public access to these services probably reduces the use of emergency health care resources, thus lowering health care costs.

(Kearney TE, Olson KR, Bero LA, Heard SE, Blanc PD: Health care cost effects of public use of a regional poison control center. *West J Med* 1995; 162:499-504)

Poison control centers nationwide are threatened with closure as state and local governments and community hospitals have reduced financial support. The ensuing policy debate has centered on the costs and benefits of these services. Poison control centers manage most cases of poisoning by providing telephone advice to a caregiver at home, obviating the need for evaluation or treatment at a health care facility.<sup>1\*</sup> We hypothesize that the loss of poison control center services could lead to major cost increases as poisoning victims overuse other, more expensive, emergency medical services (911 and local emergency departments).

Quantifying the costs and benefits of poison control centers has been difficult, however. Earlier studies have suggested that most people, in the absence of poison control center services, would indeed seek an emergency department evaluation in the face of a possibly toxic

exposure, irrespective of the nature of the poisoning.<sup>2-7</sup> Moreover, these increased emergency department evaluations often would be accompanied by the use of 911 and ambulance systems. These earlier studies have been limited by possible recall bias and incomplete cost estimates. To address these shortcomings, we interviewed study subjects within a short time after a poisoning encounter and directly surveyed health care providers cited by interview subjects as alternative caregivers in the event poison center hotline services were unavailable. From this follow-up survey, we ascertained directly from providers their standard management approaches and charges for such alternative care.

### Cases and Methods

#### *Poison Control Center Study Site*

The San Francisco Bay Area Regional Poison Control Center (PCC) has been in operation since 1979

\*See also the editorial by Toby Litovitz, MD, "Listen, Ye Legislators, Our Children Need You!" on pages 552-553 of this issue.

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This work was supported in part by grant No. R49/CCR903697-05 from the Centers for Disease Control and Prevention (CDC). The discussion and conclusions expressed in this article are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.

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**ABBREVIATIONS USED IN TEXT**

HMO = health maintenance organization  
PCC = San Francisco Bay Area Regional  
Poison Control Center

and is certified by and operated as a regional poison control center meeting the criteria set by the American Association of Poison Control Centers.<sup>8</sup> It is also designated by the California Emergency Medical Services Authority to serve a ten-county region encompassing the San Francisco Bay Area and North Coast counties, with about 4.4 million residents. The PCC telephone hotline is staffed on a 24-hour basis by licensed doctoral level (PharmD) clinical pharmacists who are certified as Specialists in Poison Information. They provide emergency information and telephone treatment advice regarding the toxicity of household products, drugs, and environmental chemicals involved in human exposures. Specialized physician backup is available on a 24-hour basis. Callers to the PCC include the general public, which has direct access by a toll-free telephone number, and professional health care providers seeking case-management advice.

During the calendar year when this study was performed (1991), the PCC handled 46,641 exposure calls, of which 34,766 (74%) were from public callers at a private residence. Of these, the majority, 25,563 (55%), concerned poisonings in children younger than 5 years. A total of 33,669 (72%) cases were managed entirely at home after PCC consultation to a caregiver (most frequently the mother of an exposed child). All cases of human poison exposures reported to the PCC were computerized using a customized data collection system. Cases entered into this system met all specifications, audit variables, and had an acceptable quality factor for the American Association of Poison Control Centers' National Data Collection System.<sup>1</sup>

During fiscal year 1991-1992, the PCC had a total operating budget of \$1.08 million. Of this, approximately 70% covered salaries and telephone expenses for the hotline staff. The ratio of exposure calls per staff member was 4,664 annually.

*Interview of Callers to the Poison Control Center*

We conducted a prospective telephone survey of public callers to the PCC using a brief standardized interview schedule. This study was approved by the Committee on Human Research, University of California, San Francisco. All interviews were carried out by a single trained surveyor. We identified interview subjects from a computer-generated list of PCC callers by selecting all even-numbered case log numbers over a six-week period.

We employed the following inclusion criteria: the PCC call was from a private home with a valid telephone number, the actual exposure site was also a private residence (as opposed to a school, workplace, or hospital), and the poisoning was managed entirely at a private res-

idence. We excluded non-English-speaking callers and any possible interview subjects not successfully reached within 72 hours of the initial PCC contact. Although the PCC caller could have been the poisoning victim, in most cases the caller was a caregiver (such as the parent of an exposed child).

We coded into categorical scenarios answers to the following open-ended question: "If you could not have reached the San Francisco Poison Control Center when you called after [name of patient] was poisoned, what would you have done?" We also asked the caregiver whether they would have provided first aid if professional advice could not be obtained. To identify who would be liable for costs incurred, we asked what type of insurance coverage the poisoned person had.

*Interview of Health Care Professionals*

We also conducted a structured telephone survey of hospital emergency departments and private medical offices that were identified as the sites of choice if the PCC were not available. This follow-up survey of health care professionals was conducted using an independent surveyor and a standardized questionnaire. Open-ended responses were coded into categorical variables. We determined who on site usually answers incoming calls from the public, whether or not the emergency department or office had a policy regarding how to handle a public poisoning call from a private residence, and what the provider would have recommended to the caller if the PCC were not available.

*Estimation of Charges*

We estimated the charges for emergency department and private physicians' office visits during calendar year 1992. In each of the ten counties served by the PCC, we ascertained charges at two health care facilities (an emergency department and a private physician's office) chosen at random from among those identified in the health care survey. We ascertained charges for basic office or emergency department visitation for a medical consultation by the physician and, for emergency department visitations, the separate physician charges incurred if not included in the basic visitation charge. Because most of the cases were children, we applied the conservative measure of pediatric rather than adult charges in all cases. We did not include laboratory, prolonged observation or monitoring, or pharmaceutical charges. We also surveyed an ambulance service in each county to determine the basic transportation charges for a unit with advanced-life-support capabilities. We computed survey responses that cited nonphysician health care professionals (such as pharmacists, nurses) as "free of charge."

The estimated average cost of non-PCC care options was computed for each of five basic scenarios for which we assigned charges: self-transport directly to an emergency department, self-transport directly to a physician's office, call an emergency department, call a physician's

office, and call 911. The charge for 911 calls was estimated by taking the sum of the mean charge for the emergency department visit plus the mean charge for ambulance transport. For the two scenarios "call an emergency department" and "call a physician's office," we refined our cost estimates based on our follow-up survey of the providers themselves. When the health care professional indicated that telephone treatment advice alone was an option, we considered this scenario as "free of charge." As a conservative measure, we also considered cost-free those providers stating that no action at all would be taken (no telephone advice and no treatment referral). This estimate assumed that patients or other caregivers would do nothing further should their health care professional give no specific guidance in the face of a possibly toxic exposure. We compared these costs with the mean cost per call incurred by the PCC.

### Statistical Analysis

We used the  $\chi^2$  statistic to test demographic differences between those interviewed and those lost to follow-up or not selected as interview subjects, to test for differences in categorical responses by type of insurance sponsorship in the PCC caller survey, and to test for differences in the background of triage personnel and responses by type of health care provider setting.

### Results

We identified 683 PCC callers meeting entry criteria. Of these, 589 (86%) were successfully surveyed, 32 (5%) declined to participate in the study, and 62 (9%) could not be reached by telephone within 72 hours of the initial poisoning call to the PCC, although they did appear to leave valid telephone numbers. There were 3,828 home-managed PCC cases over the study period from which we sampled. (The majority were ineligible for study because of missing or invalid telephone numbers for callback.) Based on computerized PCC data,

study cases were somewhat younger (proportion younger than 5 years, 82%, compared with 78% among nonstudied calls;  $P < .05$ ), and the PCC caller for study cases was more likely to be the mother of the exposed case (73% as compared with 63%;  $P < .01$ ).

The frequencies of alternative treatment scenarios reported by the respondents are presented in Table 1. In total, 464 (79%) respondents cited alternatives to a lack of PCC access that involved another health care professional. Only 125 (21%) respondents identified PCC alternatives that would not have directly involved other health care professionals, based on open-ended questionnaire responses such as "Don't know," "Do nothing," "Give first aid only," or "Call an acquaintance." The most common alternative care scenarios were "Call an emergency department" (29%), "Call a physician or another health care provider" (26%), and "Go directly to an emergency department or private physician's office" (20%). A relatively small number (24 [4%]) of those surveyed stated they would have contacted a 911 emergency response as their initial care alternative if PCC services were unavailable.

We analyzed reported alternative care scenarios by insurance status of the poisoning case (Table 1) and found significant differences. Those with private insurance coverage (either through a health maintenance organization [HMO] or private third-party coverage;  $n = 429$ ) were compared with those covered by Medi-Cal (California's Medicaid), unknown insurance status, or uninsured altogether ( $n = 160$ ). The publicly insured or uninsured more frequently cited scenarios involving immediate health care professional evaluations, "Go directly to an emergency department or a private physician's office" or "Call 911" ( $n = 57$  [35%] as compared with  $n = 87$  [20%] among those with private insurance;  $P < .01$ ). Significant differences were noted when the HMO-insured group was compared with the third-party-payer group, with the HMO-insured group more

TABLE 1.—Frequency of Alternative Options Chosen by Public Callers to the San Francisco Bay Area Regional Poison Control Center Versus Health Insurance Status or Carriers of Poisoned Patients Managed at Home ( $n = 589$ )

Alternate Care Response*	Insurance Status			Other, Don't Know, None, No. (%)	Row Total, No. (%)
	HMO, No. (%)†	Private (3rd Party), No. (%)†	Medi-Cal (Medicaid), No. (%)		
Call an emergency department (ED) . . . . .	82 (13.9)	46 (7.8)	19 (3.2)	23 (3.9)	170 (28.8)
Call a physician (MD) or other health care provider . . . . .	45 (7.6)	90 (15.3)	5 (0.8)	10 (1.7)	150 (25.5)
Go directly to an ED or MD office . . . . .	41 (7.0)	33 (5.6)	33 (5.6)	13 (2.2)	120 (20.4)
Call 911 . . . . .	7 (1.2)	6 (1.0)	7 (1.2)	4 (0.7)	24 (4.1)
All other responses‡ . . . . .	36 (6.1)	43 (7.3)	17 (2.9)	29 (4.9)	125 (21.2)
Column total . . . . .	211 (35.8)	218 (37.0)	81 (13.8)	79 (13.4)	589 (100.0)

HMO = health maintenance organization

\*Of 429 with health insurance vs 160 without or on Medi-Cal by alternative care response,  $P < .0001$ , by  $\chi^2$  analysis.

†Of 429 with health insurance, HMO vs private third-party-payer group by alternative care response,  $P < .0001$ , by  $\chi^2$  analysis.

‡Breakdown of all other responses included "Don't know" (24), "Do nothing" (23), "Give first aid only" (14), "Call an acquaintance" (14), and miscellaneous (50).

TABLE 2.—Management Options of Health Care Professionals\* for Public Calls Regarding Suspected Poisonings, by Type of Facility

Option	Response to Public		
	Hospital Emergency Department (ED), No. (%)	Private Physician's (MD's) Office, No. (%)	Total, No. (%)
Refer directly to ED or MD's office.....	11 (29)	33 (43)	44 (39)
Call 911 .....	1 (3)	16 (21)	17 (15)
Give treatment advice over the phone.....	6 (16)	9 (12)	15 (13)
Not sure of unknown responses .....	20 (53)	18 (24)	38 (33)
Total .....	38 (100)	76 (100)	114 (100)

\*Responses to question "If the poison control center was not an option, what would you recommend?"  
†P = .003 for comparison of management option by emergency department or private office, by  $\chi^2$  analysis.

likely to contact an emergency department ( $n = 82$  [39%] as compared with  $n = 46$  [21%] among those with third-party-payer coverage;  $P < .01$ ) when they did cite an alternative provider.

Of the 312 respondents who indicated they would call either an emergency department or a physician, we identified 135 specific health care professional practices (78 physicians' offices and 57 hospital emergency departments). Of these, we successfully surveyed 114 (84%; 76 [97%] of the physicians' offices and 38 [67%] of the hospital emergency departments). No private physician's office was studied in one county where none was identified. Of the health care provider respondents, 88 (77%) indicated that a nonlicensed health care professional (such as a medical clerk) handled all incoming calls from the public. Significant differences were found between hospital emergency departments and private physicians' offices, with the latter more frequently using non-health care professionals to triage public calls ( $n = 72$  [95%] as compared with  $n = 16$  [42%] for hospital emergency departments;  $P < .01$ ).

Of the health care provider respondents, 103 (90%) indicated that their practices had a specific policy for handling a call from the public involving a poisoning. Of the health care provider respondents, 100 (88%) said that their policy was to call the PCC on all poisonings. All 38 (100%) of the hospital emergency departments and 62 (82%) of the private physicians' offices would call the PCC.

Table 2 provides a breakdown by type of health care professional practice for all options cited by health care provider respondents if PCC services were not available. Significant differences were found in response by health care provider settings. A private physician's office more frequently cited "Go directly to an emergency department or a private physician's office" ( $n = 33$  [43%] as compared with  $n = 11$  [29%] among emergency departments) and "Call 911" ( $n = 16$  [21%] as compared with  $n = 1$  [3%];  $P = .003$ ).

The mean base charges ascertained for an emergency department and private physician's office visit for an asymptomatic child with a suspected poisoning were \$170 (range, \$107 to \$428) and \$54 (range, \$30 to \$125), respectively. The mean charge per ambulance transport was \$465 (range, \$345 to \$596). The mean charge incurred as a result of a 911 call followed by ambulance transport and an emergency department visit was computed as \$635.

After integrating the PCC caller and follow-up health care professional survey results and assigning these charge figures to the alternative treatment options, we computed total possible charges of \$71,924 for the 589 cases studied. All of these charges derived from only 412 cases (70% of the study respondents) with an alternative treatment option for which a charge was assigned. The total estimated charges for alternative scenarios were \$19,040 for those who would go directly to an emergency department and \$432 for those who would go directly to a physician's office. The total charges for those who would call either an emergency department, physician's office, or 911 were \$10,870, \$26,342, and \$15,240, respectively.

The comparative cost to handle all 589 survey cases by PCC telephone consultation was \$13,547, based on a per-case cost of \$23 computed from the PCC total operating budget for fiscal year 1991-1992. Based on these data, the total net cost savings for 33,669 home-managed cases by the PCC for calendar year 1991 was \$3.3 million. Figure 1 provides a comparative break-

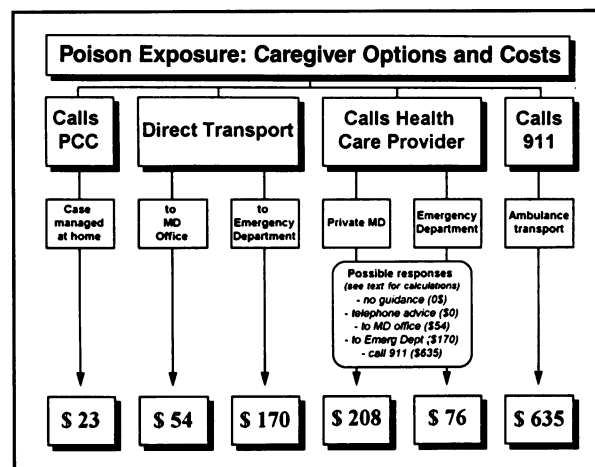


Figure 1.—The diagram shows comparative mean per-case charges for alternative care scenarios cited by poison control center (PCC) callers. All responses to the hypothetical open-ended question "If you could not have reached the poison center when you called after [name of patient] was poisoned, what would you have done?" for which a charge could be ascertained were included. For the mean per-case charges under "Calls Health Care Provider," the charge estimate assumes PCC callers would not take the patient to a health care facility when the health care provider response was "no advice would be given." A "free of charge" was assigned for this scenario or if telephone advice alone was cited by the health care provider. The cost of a 911 response includes transport and emergency department visit.

down of alternative care options taken by the study respondents and the corresponding average per-case charges versus the operating cost per PCC-home-managed case.

## Discussion

Our study suggests that poison control centers can greatly reduce the use of other care services, providing a large savings in health care costs. Our findings confirm previous investigations of alternatives to poison control center case management, while providing specific cost and charge data not included in earlier studies.<sup>1,6</sup>

Although we focused on direct cost savings, this is a conservative assessment because it does not include likely indirect benefits of poison center services. For example, one benefit of poison control center services not integrated into our analysis is the effect of timely, expert guidance for assessment and first aid. Without appropriate experience, it is difficult to properly assess risk from a poisoning exposure. Consistent with the public perception of risk, even after nontoxic exposures, 120 (20%) study respondents said that, without access to the poison control center, they would take the exposed person directly to a health care professional. Conversely, we also found that those surveyed would have proceeded with alternative first-aid measures without professional guidance. The likelihood of inappropriate first aid is great, especially given the documented variety of information printed on product labels, some of which recommend first-aid procedures that are more hazardous than the product itself.<sup>9,10</sup>

Another problem-ridden response suggesting a poison control center benefit difficult to quantify is the alternative scenario of no action at all. The "wait and see what happens" approach may result in a delay in proper care for exposures, where toxicity is likely without evaluation and treatment. Even if cases self-refer appropriately, private physicians' offices may be ill-equipped to handle serious medical emergencies.<sup>11</sup>

A lack of poison control center services could create other hardships, albeit without direct health care costs. In particular, parents of young children exposed to possible toxins are likely to experience considerable stress due to uncertainty while on a frantic trip to their local emergency department or private physician's office followed by a likely extended period of waiting for care.

Local emergency response systems are overburdened and under heavy public demand.<sup>12</sup> Although prudent public health care policy aims to reduce unnecessary use of emergency departments and other emergency services,<sup>13,14</sup> our study indicates that a loss of poison control center access would have the opposite effect. This would be further exacerbated by the higher proportion of publicly insured or uninsured in our study who were more likely to proceed directly to an emergency department or to call 911 for emergency assistance.

Our study may be subject to selection bias. The study group, with a somewhat greater proportion of women calling about their exposed child, may react differently

to the hypothetical situation we provided than that for the general population of poison control center callers. Reported alternative scenarios may be conservative, however, because those surveyed had the knowledge when surveyed *ex post facto* that the "poisoning" case indeed did well with simple home management. Another bias may occur in our assessment of the behavior of health care professionals when faced with a hypothetical caller with a toxic exposure. For example, such responses could change over time in a region where access to a poison control center was lost, although this could as easily evolve to more aggressive (and costly) care in the face of medical uncertainty.

Our cost estimates were based on the lowest possible charges incurred from an emergency department or physician's office visit. Again, these were conservative estimates because special monitoring, laboratory procedures, and medication would likely be administered, in some cases augmenting costs. We also conservatively assumed that callers would have done nothing more had their health care professional given no specific telephone guidance in the absence of poison control center services. In all likelihood, a proportion of such callers would self-refer for on-site evaluation despite the lack of a physician's recommendation to do so.

As with most poison control centers nationally, the bulk of funding to the poison control center is local and voluntary. Consistent reductions in poison control center funding have come from its sponsoring hospitals and county, as well as the state general fund. This trend of a loss of governmental and sponsoring hospitals has been mirrored by poison control centers throughout the State of California and nationwide. Four California poison control centers were threatened with closure in fiscal year 1991-1992, with one poison control center in 1992 and one in 1993 actually closing.

In summary, direct public access to poison control center services probably reduces the consumption of emergency health care resources and thereby reduces health care costs. The estimated charges for hypothetical alternative care options if the PCC were not available may exceed the cost for poison control center telephone consultation by a factor of at least five. The loss of poison control center services may have a substantial financial impact on third-party and government-based health insurers alike, adding a major burden to overall health care costs.

## Acknowledgment

The contributions of the staff of the San Francisco Bay Area Regional Poison Control Center made this study possible.

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## The Abortion

She came across in the hands of paramedics  
 who had stuffed her full of packing  
 and wore her bright blood in their laps.  
 "Light bulb," their report read,  
 "self-inflicted." She hissed  
 straight past the whispering  
 ER doors to us, the OR—  
 floor of last resort.

As we unravelled bandages  
 she went the color of old wax.  
 Stained shards tinkled to the floor  
 and clotted to our shoes  
 as we tried to keep her  
 (so sharded, so small,  
 the long ones imbedded in the blooming  
 bulb of uterus) and though we worked  
 to get her back, she bled out  
 on our clean white sheets.

Mitch, who gave the anesthesia,  
 pumping sweet air and oblivion,  
 helped me wrap the shroud  
 and then we dropped our blood-  
 drenched scrubs and all constraint  
 at the men's room door and together  
 in the little shower, we let the water,  
 hot as we could stand it,  
 wash over us.

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